Chance Deference *De Se*

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Abstract: Principles of chance deference face two kinds of problems. In the first place, they face difficulties with *a priori* knowable contingencies. In the second place, they face difficulties in cases where you've lost track of the time. I provide a generalisation of these principles which handles these problem cases. The generalisation has surprising consequences for Adam Elga's *Sleeping Beauty* puzzle.

1 INTRODUCTION

Principles of chance deference tell you to treat information about the future objective chances as a particularly strong form of evidence. Let t be some future time. Then, so long as circumstances are ordinary and you don't have any information about what happens after t, a principle of chance deference says that, given that the time t objective chance of 'p' is n%, you should be n% sure that 'p' is true.[1,2]

Principles like this run into two kinds of problems. In the first place, they give bad advice about *a priori* knowable contingencies. Consider the following example, from John Hawthorne and Maria Lasonen-Aarnio:[3] tomorrow, we will draw 100 names from an urn, and the person whose name is drawn will win a prize. Before the draw takes place, we introduce the name 'Lucky' for the person whose name is actually drawn. We don't yet know the truth-conditions

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1. Following philosophical tradition, I reserve the world 'chance' for objective probabilities. Throughout, my focus is on *tychistic* chance, which I distinguish from *deterministic* chance. If the fundamental laws of nature are deterministic, then tychistic chances are just truth-values—the tychistic chance of 'p' will be 0 if 'p' is false and 1 if 'p' is true. It is only when the fundamental laws of nature are probabilistic that we can have non-trivial tychistic chances.
2. Throughout, I'm going to sloppily use regular quotation marks for quasi-quotation.
3. Hawthorne & Lasonen-Aarnio (2009)

of 'Lucky wins'. If Sundar actually wins, then what it takes for 'Lucky wins' to be true is for Sundar to win. If Evîn actually wins, then what it takes for 'Lucky wins' to be true is for Evîn to win. Even though we don't know what the truth-conditions of 'Lucky wins' are, we know for sure that those truth-conditions have a 1% objective chance of being satisfied. *Whoever* Lucky is, they have a 1% chance of winning the prize, same as everyone else. A principle of chance deference will therefore tell us to be 1% sure that Lucky wins. But surely we should be nearly 100% sure that Lucky wins. It is, after all, *a priori* knowable that, if anybody wins, then Lucky does.[4]

In the second place, principles of chance deference appear to give bad advice when you have lost track of the time. For instance, you may have evidence about *today*'s chances without having evidence about, for instance, *Monday*'s chances or *Tuesday*'s chances. In cases like this, when we apply the standard principles of chance deference to the Monday chances, they will tell you that your credence in '*p*' should diverge from what you know for sure to be *today's* chance of '*p*'.

In a companion paper, *Expert Deference De Se*, I introduce an emendation to standard principles of expert deference which allows them to deal with *de se* thoughts—thoughts about who you are, where you are, or what time it is. In this paper, I will motivate and explore what this general principle has to say about showing deference to the objective chances. The principle of chance deference I will defend differs from more familiar principles of chance deference in two ways. In the first place: I will not tell you to align your credence in 'Lucky wins' with the objective chance of Lucky winning—instead, I will tell you to align your credence in 'Lucky wins' with the objective chance of an appropriately chosen *surrogate* of 'Lucky wins'. In the second place: I will only tell you to align your credences with the objective chances *conditional on* who you are, and when and where you are located in space and time.

In a slogan, my proposal is this: you should defer to the objective chances about whether your thoughts are true, given your *location*, where a location is a thought which specifies who you are, where you are, and what time it is. I'll close by applying this principle of chance deference to Adam Elga's *Sleeping Beauty* puzzle.[5] David Lewis took his principle of chance deference to mili-

4. Similar cases are discussed in Schulz (2011), Titelbaum (2012), Nolan (2016), and Salmón (2019).

5. Elga (2000)

tate against Elga's 'thirder' solution to that puzzle.[6] However, the principle of chance deference I will propose here is perfectly consistent with the 'thirder' solution. In contrast, it is *inconsistent* with Lewis's own 'halfer' solution.

2 | LEWIS'S PRINCIPLE OF CHANCE DEFERENCE

David Lewis thought that you should defer to the objective chances by adhering to the following principle.[7]

> LEWIS'S PRINCIPLE OF CHANCE DEFERENCE
> For any thought 'p', any number $n\%$, and any time t, your credence in 'p', given that the time t chance of 'p' is $n\%$, should be $n\%$,
>
> $$\text{(LCD)} \qquad C(p \mid Ch_t(p) = n\%) \stackrel{!}{=} n\%$$
>
> (so long as you lack any time t inadmissible information)

Let me offer a few comments on this principle. Firstly, on notation: '$C(p)$' is your credence function. You hand it a thought, 'p', and it hands you back a number between 0% and 100%. '$C(p \mid q)$' is your *conditional* credence function. You hand it a pair of thoughts, 'p' and 'q', and it hands you back a number between 0% and 100% which indicates how confident you are in 'p', on the indicative supposition that 'q' is true. In a conditional credence $C(p \mid q)$, I'll call 'q' *the antecedent* and 'p' *the consequent.* If the antecedent is epistemically impossible, then a rational conditional credence will not be defined. Throughout, whenever I write a schematic formula like LCD specifying what your conditional credences should be, I only mean to endorse substitution instances for which the antecedent is epistemically possible. If the antecedent is epistemically possible but is given a credence of zero, then the conditional credence will only be defined relative to the additional parameter of a partition.[8] I'll ignore issues having to do with conditioning on credence zero thoughts in the main body, but I'll have more to say about them in the footnotes.[9] I will take it for

6. Lewis (2001).

7. See Lewis (1980). LCD isn't the same as Lewis's *Principal Principle*, though it follows from the Principal Principle given the updating rule of conditionalisation.

8. See Easwaran (2019). I say that the set of thoughts **r** *partitions* 'q' iff it is *a priori* knowable that q is true iff exactly one of the thoughts in **r** is true and for no thought 'r' in **r** is it *a priori* knowable that 'r' is false. And **r** is *a partition* just in case it partitions a tautology.

9. Lewis thought that no epistemically possible thought should be given a credence of zero, so he was not concerned with relativising conditional credences to partitions. (This required him

granted that your conditional and unconditional credences are related in the following way, for any 'p' and 'q': $C(p \mid q) \cdot C(q) = C(p \wedge q)$.[10] "$\mathcal{C}h_t$" is the definite description "the time t objective chance function". Thus, '$\mathcal{C}h_t(p) = n\%$' says that the time t objective chance of 'p' is $n\%$. I place an exclamation mark over an equals sign to indicate that the equality *ought* to hold, and not that it *does* hold. Thus, LCD says what your credences *ought* to be like; it doesn't say anything about what they *are* like.

Finally, two comments on terminology. Firstly, Lewis calls information 'time t inadmissible' iff the information is *about* times after t. So long as you are at a time before t, the only way Lewis thought you could come to have inadmissible information was by way of time travellers, crystal balls, oracles, and the like. So long as there's no funny business like that, and so long as it's before the time t, Lewis's criterion of inadmissibility will allow us to ignore the parenthetical proviso. Secondly, I stipulatively reserve 'thought' for whatever the arguments of your credence function happen to be. In his *A Subjectivist's Guide to Objective Chance*, Lewis assumes that the arguments of your credence function are truth-conditions, or sets of metaphysically possible worlds. However, he treats this as a simplifying assumption which would be lifted in a more general treatment.[11] In general, Lewis takes the arguments of your credence function to be properties, or sets of *centred* possible worlds.[12] So, for Lewis, thoughts are properties. If your credence in a property is high, then you are confident that you have the property—low, and you are not confident that you have the property.

I'll argue in §§2.1–2.2 that Lewis's principle LCD faces two kinds of prob-

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to use infinitesimal credences—for more, see Williamson (2007), Easwaran (2014), and Hájek (ms).) If we part ways with Lewis and allow that an epistemically possible thought may be given a credence of zero, then the natural partition to use in understanding LCD is $\{\mathcal{C}h_t(p) = n\% \mid n\% \in [0, 1]\}$.

10. I will assume throughout that your unconditional credences satisfy the following two rationality constraints: (i) if it's *a priori* knowable that 'p' is true, then $C(p)$ =100%; and (ii) if it's *a priori* knowable that no two of 'p_1', 'p_2', 'p_3', ... are both true, then $C(p_1 \vee p_2 \vee p_3 \vee \dots) = C(p_1) + C(p_2) + C(p_3) + \dots$. I will also take for granted that your *conditional* credences satisfy the following rationality constraint, known as *conglomerability*: for any thoughts 'p' and 'q', and any set of thoughts $\mathbf{r}$ which *partitions* 'q', your conditional credence $C(p \mid q)$ lies in the range of the conditional credences $C(p \mid r)$. That is:

$$\inf_{r \in \mathbf{r}} C(p \mid r) \leqslant C(p \mid q) \leqslant \sup_{r \in \mathbf{r}} C(p \mid r)$$

11. See Lewis (1980, p. 268).

12. See Lewis (1979).

lems. In the first place, it faces problems with *a priori* knowable contingencies. (This problem has been noted and discussed by Hawthorne & Lasonen-Aarnio (2009), Schulz (2011), Nolan (2016), and Salmón (2019), among others.) In the second place, it faces problems in cases where you've lost track of the time. (To my knowledge, this second problem has not been recognised before.)

2.1 *A Priori Knowable Contingencies*

To illustrate the first problem, suppose that we are going to flip a coin at time t, and, at some point before t, I introduce the name "Uppy" by saying "Let's call whichever side of the coin actually lands up 'Uppy'". Let 'u' be the thought that the coin lands with Uppy facing up. Then, if we set 'p' equal to u and we set n equal to 50%, LCD tells us that your credence in 'u', given that the objective chance of 'u' is 50%, should be 50%.

$$C(u \mid Ch_t(u) = 50\%) \stackrel{!}{=} 50\%$$

But you know for sure that the objective chance of 'u' is 50%. For you know for sure that Uppy is either heads or tails. If Uppy is heads, then the chance of the coin landing on Uppy is the chance of the coin landing on heads, which is 50%. And if Uppy is tails, then the chance of the coin landing on Uppy is the chance of the coin landing on tails, which is 50%. So, either way, the chance of the coin landing on Uppy is 50%.[13] If C is a probability—and I'll suppose for the nonce that it is—and you know something for sure, then you may ignore it when it appears as an antecedent in a conditional credence. That is: if $C(q) = 100\%$, then $C(p \mid q) = C(p)$. So LCD says that your credence in 'u' should be 50%,

$$C(u) \stackrel{!}{=} 50\%$$

This looks like bad advice. After all, it is *a priori* knowable that the coin lands on Uppy (so long as it lands on anything at all). So it looks like your credence in 'u' should be close to 100%, and not down around 50%.

One reaction to this kind of case is to suggest that the naming ceremony in which "Uppy" was introduced has provided you with some kind of inadmissible information. Appeals to inadmissibility often show up in conversa-

13. Actually, the chance that a flipped coin lands heads is best understood as a *deterministic* chance, not a *tychistic* chance (which is my focus here). I'll stick to coin flips in the interests of readability, but if we want to be ideally careful, we should think of the coin as a quantum system in the state $\sqrt{1/2} \cdot |\text{heads}\rangle + \sqrt{1/2} \cdot |\text{tails}\rangle$, and we should think of 'flipping' the coin as measuring whether it is in the state $|\text{heads}\rangle$ or $|\text{tails}\rangle$.

tion about the case, and more careful versions of the reaction show up in the work of Wolfgang Schwarz and Jack Spencer.[14] While a naïve version of the response faces some serious problems, the more careful approach of Schwarz and Spencer is able to successfully deal with this problem. However, the principles advocated by Schwarz and Spencer will still face the second difficulty which I will introduce in §2.2 below.

Let me make two points about the naïve version of this response. Firstly, if the dubbing ceremony provides you with inadmissible evidence, then inadmissible evidence is much easier to come by than Lewis indicates in *A Subjectivist's Guide to Objective Chance*. As I mentioned in §2.1 above, so long as they are sitting around before the time t, Lewis thought that ordinary humans left to their own devices would only have time t admissible evidence. It is only with time travel or prognostication that ordinary humans could come to possess inadmissible information.[15] But ordinary humans left to their own devices are perfectly capable of introducing names like "Uppy" without the assistance of crystal balls, oracles, or time machines. Secondly—and more importantly—we can generate this problem for LCD without any dubbing ceremony or the introduction of any *name* at all. All we need is the rigidified definite description 'the side of the coin which actually lands up'. You should be certain, or nearly certain, that the side of the coin which actually lands up lands up, but you are also certain, or nearly certain, that the chance of this happening is 50%. We can even create this kind of trouble for LCD with just demonstratives like 'this coin'. So it seems that any solution which appeals to the kind of knowledge gained in dubbing ceremonies isn't going to solve the problem in general.

I take it that what drives this kind of response to the problem is the idea that you simply shouldn't be deferring to chance about thoughts like 'the coin lands on Uppy'. This is a natural thought, and while it isn't implied by Lewis's admissibility clause, it can be developed into an adequate solution to the puzzle. For instance, Schwarz offers the following emendation of LCD (the difference is

14. See Schwarz (2014) and Spencer (2020).

15. Admittedly, Lewis had adopted a much more liberal conception of inadmissibility by 2001, when he said that learning what time it is can provide you with inadmissible information about the future, "namely, that [you] are not now in it" (Lewis, 2001, p. 175). I won't have anything to say about this view of admissibility beyond the following observation: if all it takes to have time t inadmissible information is to know that it is now before t, then we would have inadmissible evidence about the outcome of a coin flip whenever we know that the coin flip will take place in the future. So, if we understand 'inadmissibility' in this incredibly liberal sense, principles like LCD won't constrain our credences in even this paradigm case.

in the parenthetical proviso):[16]

> SCHWARZ'S PRINCIPLE OF CHANCE DEFERENCE
> For any thought 'p', any number n%, and any time t, your credence in 'p', given that the time t chance of p is n%, should be n%,
>
> (SCD) $$C(p \mid \mathcal{C}h_t(p) = n\%) \stackrel{!}{=} n\%$$
>
> (so long as you don't have any time t inadmissible information, *and so long as the thought 'p' is apt for deference at t*).

So long as the thought 'the coin lands on Uppy' is not apt for deference, SCD won't fall prey to the counterexample which beset LCD.

What SCD is capable of telling us depends upon how many thoughts are apt for deference at t; and, before it tells us anything at all, we must have an account of which thoughts are apt for deference at t and which are not. A natural suggestion is this: a thought is not apt for deference at t whenever the truth-conditions of that thought depends upon matters which are chancy at t. That is: 'p' is apt for deference at t iff, for some truth-condition (some set of metaphysically possible worlds) P, there's a positive chance at t that P is the truth-condition of 'p', and there is a positive chance at t that P is *not* the truth-condition of 'p'. This first pass suggestion might require further Chisholming, but it will do as a rough-and-ready characterisation of which thoughts are apt for deference at t.

2.2 *Losing Track of the Time*

To illustrate the second problem, suppose that you don't know whether it's Monday or Tuesday, but you think it's equally likely to be either. That is: you're 50% sure that today is Monday, and 50% sure that today is Tuesday. And, while you don't know what day it is, you know for sure that *today*'s chance of Secretariat winning the race ('w') is 75% and that *yesterday*'s chance of Secretariat winning the race was 25%. Then, if we set 'p' equal to 'w', t equal to Monday (mon), and n% equal to 25% and 75%, respectively, both LCD and SCD tell us that

$$C(w \mid \mathcal{C}h_{mon}(w) = 25\%) \stackrel{!}{=} 25\%$$

16. See §3 of Schwarz (2014). Schwarz intends his principle to apply to deterministic chances as well as tychistic chances; for this reason, his explicit presentation of the principle has some additional bells and whistles which mine lacks. In the present context, I'm only concerned with tychistic chance. See footnotes 1 and 13.

$$\text{and} \qquad C(w \mid \mathcal{C}h_{mon}(w) = 75\%) \stackrel{!}{=} 75\%$$

You know for sure that $\mathcal{C}h_{mon}(w) = 25\%$ iff it is Tuesday ('*tuesday*'), and you know for sure that $\mathcal{C}h_{mon}(w) = 75\%$ iff it is Monday ('*monday*'). If $C(q) > 0$ and you know for sure that $q \leftrightarrow r$, then $C(p \mid q) = C(p \mid r)$. So this implies:

$$C(w \mid \textit{tuesday}) \stackrel{!}{=} 25\%$$
$$\text{and} \qquad C(w \mid \textit{monday}) \stackrel{!}{=} 75\%$$

Since you are 50% sure that it is Monday and 50% sure that it is Tuesday, this implies (*via* the law of total probability) that

$$\begin{aligned} C(w) &= C(w \mid \textit{monday}) \cdot C(\textit{monday}) + C(w \mid \textit{tuesday}) \cdot C(\textit{tuesday}) \\ &\stackrel{!}{=} 75\% \cdot 50\% + 25\% \cdot 50\% \\ &= 50\% \end{aligned}$$

But this looks like bad advice. After all, you know for sure that *today*'s chance of Secretariat winning is 75%. Given that, it seems that you should be 75% sure that Secretariat wins, and not merely 50% sure.

A thought like 'Secretariat wins' should count as apt for deference on either Monday or Tuesday. The race won't be run until Wednesday (let's say), and there doesn't seem to be any funny business with naming. Moreover, 'Secretariat wins' will count as apt for deference according to the rough-and-ready characterisation I offered Schwarz above. On Monday, it is not a matter of chance what the truth-conditions of 'Secretariat wins' are. So 'Secretariat wins' should be apt for deference.

But there is another way out: LCD and SCD will only imply that your credence that Secretariat wins should be 50% *if* we assume that you don't have any Monday-inadmissible information. And you might suspect that, in this case, you *do* have some Monday-inadmissible information. After all, for all you're in a position to know for sure, today is Tuesday. And if it is Tuesday, then your knowledge that *today's* chance of '*w*' is 75% is Monday-inadmissible information.

It's true that, *if* today is Tuesday, then your information that today's chance of '*w*' is 75% will be about times after Monday, and so will count as Monday-inadmissible, according to Lewis's criterion. But nothing about the case requires us to suppose that today is Tuesday. Suppose that, unbeknowst to you, today is in fact Monday. If that's the case, then your information that today's chance of 'w' is 75% will not be about times after Monday, and so will not count as inadmissible, given Lewis's criterion. More broadly, if today is in fact Monday, then, given that there are no crystal balls or oracles around, it's difficult to see how you could have come by any information about times after Monday. And so it's difficult to see how you could have acquired any information which is inadmissible, given Lewis's criterion.

But perhaps we should revise Lewis's criterion of inadmissibility. Perhaps we should say that information is time t inadmissible iff, *for all you're in a position to know for sure*, it is about times after t.[17] Then, we could say that, since the information 'today's chance of 'w' is 75%' *might* be about times after Monday, you should not defer to the Monday chances. As I'll discuss in §3.3 below, I think that there is *something* deeply right about this response. In particular, I think that you have sufficient reason to have a credence of 75% in 'w', in spite of the fact that your expectation of the Monday chance of 'w' is 50%. Moreover, I think that this is true precisely *because* you think that it might be Tuesday. In §3.2 below, I'll provide a criterion of inadmissibility according to which, in this case, you have Monday inadmissible information. While I think that we *should* say that you have inadmissible information in this case, I don't think this is sufficient to resolve our puzzle, without any further revision to the principles LCD or SCD. Suppose that there is a countable infinity of times, $t_1, t_2, t_3, \ldots$, which might, for all you know, be the current time. As before, while you don't know the time, you do know that the *current* chance of Secretariat winning is 75%. In this kind of case, a principle of chance deference should tell you to set your credence in 'w' to 75%. However, if knowing something about what the t_{i+1} chances *might* be is all that it takes for you to have time t_i inadmissible information, then you will have information which is time t_i inadmissible, for *every* time t_i. And, in that case, neither LCD nor SCD would tell you to defer to the chances at *any* time. And so neither would require your credence in 'w' to be 75%.

3 | CHANCE DEFERENCE *DE SE*

Principles of chance deference like LCD and SCD are instances of a broader class of principles of *expert* deference. And, in general, principles of expert deference face difficulties when it comes to *de se* thoughts—thoughts which are in

17. Cf. Wilson (2014, §6), who suggests that you should not defer to the chances when you have evidence which *might be* about the future.

part about who you are and where you are located in space and time. For instance, let the relevant expert be Beyoncé's doctor. A naïve principle of doctor deference would tell Beyoncé that, given that her doctor's credence in 'p' is n%, her credence in 'p' should be n%, too. That is, if 'C' is Beyoncé's credence function, then:

$$C(p \mid \mathcal{D} = D) \stackrel{!}{=} D(p)$$

where '$\mathcal{D}$' is the definite description 'Beyoncé's doctor's credence function', and 'D' is any particular probability function.

Set 'p' equal to the *de se* thought 'I am sick' ('s'). Then, this principle of doctor deference will tell Beyoncé: "given that your doctor is confident in 'I am sick', you should be confident in 'I am sick', too". But this is terrible advice. When Beyoncé's doctor entertains the thought 'I am sick', they entertain a thought which is true iff *they* are sick. When Beyoncé entertains that same thought, she entertains a thought which is true iff *she* is sick. Since there's no connection between Beyoncé's health and her doctor's health, she should not see her doctor's high credence in 'I am sick' as imposing any rational constraint on her own credence in 'I am sick'. (The reader may suspect that the doctor's thought 'I am sick' is not the same as Beyoncé's thought 'I am sick'. These kinds of worries are addressed in the companion paper *Expert Deference De Se*, §2 and appendix A.)

Beyoncé should not defer to her doctor by setting her credence in 'I am sick' equal to the doctor's credence in *that same de se thought*. Instead, she should defer to them by setting her credence in 'I am sick' equal to their credence in some appropriately chosen *surrogate* of that *de se* thought. In this case, the appropriate surrogate is 'Beyoncé is sick'. In §3.1, I will provide a general surrogate which you should use whenever you are deferring to an expert.

3.1 Locational Surrogates

As a rough, first-pass suggestion: the general surrogate for your thought p should be 'your thought p expresses a truth'. Then, our principle of expert deference would tell us: given that the expert is n% confident that your thought p expresses a truth, you should be n% confident in p. This first-pass suggestion runs into difficulties when either you or the expert are unsure of who you are, where you are, or what time it is. To deal with these kinds of cases, I'll say what it is for a thought to be a *location*, and then, rather than looking at a *single* surrogate for your thought p, I'll look at a *family* of surrogates: one for each potential location. This surrogate will say, roughly and metaphorically, that p expresses a truth for the person at that location. The resulting principle of expert deference will say (roughly): given that you are at a location, λ, your credence in p should be equal to the expert's credence that p expresses a truth for someone at λ.

I'll explain what I mean by calling a thought a *location* by starting with the notion of a *purely de se* thought. A thought is *purely de se* iff it only says something about who you are, or when and where you are located in space and time, and it doesn't additionally tell you anything about what the world is like—that is, it doesn't provide you with any *de dicto* information. Then, a *location* is a thought which is strong enough to settle the truth-value of all of your purely *de se* thoughts—and no stronger. In other words: a location tells you who you are, where you are, and what time it is in as rich a detail as your purely *de se* thoughts will permit—and it doesn't tell you anything more than this. Despite the suggestive name, a location is not a person, place or time. It is just a particular kind of thought. I'll talk about *being at* or *occupying* a location, but this is just a helpful metaphor. When I say that you are *at* the location λ, I just mean that λ expresses a truth for you. As a notational convention, I'll use lowercase Greek letters like 'λ' to indicate that a thought is a location (except 'ω', which I reserve for worlds—see below).

We can similarly define a *world* to be a thought which is strong enough to settle the truth-value of all of your *de dicto* thoughts—and no stronger. In other words: a world tells you exactly what things are like, in as rich a detail as your *de dicto* thoughts will permit—and it doesn't tell you anything more than this. Again, despite the name, a world is just a particular kind of thought. If I say that you are *in* the world ω, I mean only that ω expresses a truth for you. As a notational convention, I'll reserve 'ω' for a world. Worlds will be compatible with some locations, and incompatible with others.[18] For instance, any world which says that Beyoncé does not exist is incompatible with a location which tells you that you are Beyoncé. If a world ω and a location λ are compatible, then call the pair (ω, λ) a *centred world*. If (ω, λ) is a centred world and the material conditional '$(\omega \wedge \lambda) \to p$' is *a priori* knowable, then say that 'p' is *true at* the centred world (ω, λ).

Locations allow us to express the thought that 'I am sick' is true *for Beyoncé*. Let 's' be the thought 'I am sick', and let 'β' be Beyoncé's location. Then, we may let 's_β' be a thought which is true so long as 's' is true when entertained at the location 'β'. That is, we can say that 's_β' is true at a centred world (ω, α) so

18. The world ω is incompatible with the location λ iff '$\sim(\omega \wedge \lambda)$' is *a priori* knowable.

long as 1) (ω, β) is a centred world, and 2) 's' is true at (ω, β). In general, take any thought 'p', and any location, 'λ'. Then, what we may call the λ-surrogate of 'p'—which I will write 'p_λ'—is a thought which is true so long as 'p' is true when entertained at the location λ. More carefully, say that 'p_λ' is true at a centred world (ω, α) so long as 1) (ω, λ) is a centred world, and 2) 'p' is true at (ω, λ).[19]

Now, we can give Beyoncé the advice: your credence in 's' should equal your doctor's credence in the β-surrogate of 's', 's_β'. That is, if $\mathcal{D}$ is the definite description 'my doctor's credence function', and 'D is any probability function, Beyoncé's credence function, C, should satisfy:

$$C(s \mid \mathcal{D} = D) \stackrel{!}{=} D(s_\beta)$$

This works well so long as Beyoncé knows for sure what her location is. But what if she is uncertain about her location? Suppose, for instance, that Beyoncé doesn't know whether she is Kelly or Beyoncé. In that case, Beyoncé's credences should satisfy the following: given that she is Beyoncé and her doctor is n% sure that Beyoncé is sick, she should be n% sure of 'I am sick'. And, given that she is Kelly and her doctor is n% sure that Kelly is sick, she should be n% sure of 'I am sick'. That is, if 'β' is Beyoncé's location, 'κ' is Kelly's location:

$$\begin{aligned} & C(s \mid \mathcal{D} = D \wedge \beta) \stackrel{!}{=} D(s_\beta) \\ \text{and} \quad & C(s \mid \mathcal{D} = D \wedge \kappa) \stackrel{!}{=} D(s_\kappa) \end{aligned}$$

More generally, you should defer to an expert, $\mathcal{E}$, as described below:

> EXPERT DEFERENCE *DE SE*
> Given that the expert $\mathcal{E}$'s probability function is E, and given that you are located at λ, your credence in 'p' should be E's probability in the λ-surrogate of 'p', 'p_λ'.[20]
>
> $$C(p \mid \mathcal{E} = E \wedge \lambda) \stackrel{!}{=} E(p_\lambda)$$

In a slogan: you should defer to the expert about whether your thoughts are

19. See §B.3 of the companion paper *Expert Deference De Se* for a more general and careful definition of the locational surrogate 'p_λ'.

20. If '$\mathcal{E} = E \wedge \lambda$' has a credence of zero, then this conditional probability should be relativised to the partition of every epistemically possible conjunction which has the form '$\mathcal{E} = E \wedge \lambda$', with '$\mathcal{E}$' fixed and '$E$' and '$\lambda$' variable.

true, given the location at which you are entertaining them. (In the companion paper, I give some reasons why this principle should be generalised further, but those generalisations won't be relevant when the expert is the objective chances, so I'll ignore them here.[21])

Applying this general principle to the expert of chance, we should say this:

> So long as you lack any time t inadmissible information, your credence in 'p', given that the time t objective chance function is Ch, and given that you are located at λ, should be equal to $Ch(p_\lambda)$.

$$C(p \mid Ch_t = Ch \wedge \lambda) \stackrel{!}{=} Ch(p_\lambda)$$

In a slogan: you should defer to chance about whether your thoughts are true, given the location at which you are entertaining them—so long, that is, as you lack any inadmissible information.

3.2 A Priori Knowable Contingencies

Return to the first problem for LCD—the problem with *a priori* knowable contingencies. Recall: 'u' says that the coin lands on Uppy, where 'Uppy' is a name for whichever side the coin actually lands on. Let 'λ' be your location, which we'll take you to know for sure (just for the sake of simplicity). Then, the λ-surrogate of 'u', 'u_λ' is a thought which is true so long as 'u' expresses a truth at the location λ. Your location doesn't play an important role in determining the truth-conditions of 'u_λ'. 'u' will express a truth for you just in case it expresses a truth for anyone else in your world. So, more simply, 'u_λ' is a thought which says that 'u' expresses a truth. Our proposed principle of chance deference says: your credence in 'u', given that the objective chance function is Ch, should be the objective chance that 'u' is true.

$$C(u \mid Ch_t = Ch) \stackrel{!}{=} Ch(\text{`}u\text{' is true})$$

(Since I'm supposing you know λ for sure, $C(u \mid Ch_t = Ch \wedge \lambda) = C(u \mid Ch_t = Ch)$, and for any chance function, Ch, $Ch(u_\lambda) = Ch(\text{`}u\text{' is true})$.)

This is enough to solve our first problem. Even though there's only a 50% chance that the coin lands on Uppy, there is a *100%* chance that your thought

21. As I also explain in the companion paper, we should limit the principle to only apply when the location λ is *atomic*. (A location λ is atomic iff, for every world ω such that (ω, λ) is a centred world, and for every thought p, either $(\omega \wedge \lambda) \to p$ or $(\omega \wedge \lambda) \to \sim p$ is *a priori* knowable.) I'll take it for granted throughout that all locations are atomic.

'u' is true. If the coin lands heads, then 'u' will say that the coin lands on heads, and this will be true. On the other hand, if the coin lands tails, then 'u' will say that the coin lands on tails, and this will be true. So "'u' is true' will be true no matter how the coin lands. So the principle will tell you that

$$C(u \mid Ch_t = Ch) \stackrel{!}{=} 100\%$$

And since it will say this for *every* potential chance function Ch, the principle will imply that your unconditional credence in 'u' should be 100%.[22]

It's worth going through that again, a bit more carefully. In this case, there are two relevant scenarios. Either the coin will actually land heads, or it will actually land tails. If the coin actually lands heads, then 'u' will be true if the coin lands heads, and false if the coin lands tails. And if the coin actually lands tails, then 'u' will be true if the coin lands tails, and false if the coin lands heads. This is illustrated in the 'two-dimensional' array below.[23]

'u'	**heads**	**tails**
heads	T	F
tails	F	T

Here's how to read the array: the first row gives us'u's truth-conditions, if we suppose that the coin actually lands heads. So the first row tells us that, if the coin actually lands heads, then 'u' is true in heads possibilities and false in tails possibilities. The second row gives us 'u's truth-conditions, if we suppose that the coin actually lands tails. So the second row tells us that, if the coin actually lands tails, then 'u' is false in heads possibilities and true in tails possibilities.

The truth-conditions of 'u' vary, depending upon what things are actually like. Because this is so, I will call the thought 'u' *interesting*. Contrast 'u' with the thought that the coin lands on heads, which we can write 'h'. This thought has exactly the same truth-conditions (true in heads possibilities, false in tails possibilities), no matter what actually happens.

'h'	**heads**	**tails**
heads	T	F
tails	T	F

22. Here, I appeal to the principle of *conglomerability* (the third rationality constraint from fn 10). For conglomerability implies that, if you have a set of thoughts $\mathbf{r}$ which *partitions* the thought 'q', and $C(p \mid r) = n\%$ for each 'r' $\in \mathbf{r}$, then $C(p \mid q) = n\%$, too. For more on conglomerability, see Easwaran (2013) and Easwaran (2019).

23. To be clear: I'm understanding these two-dimensional arrays *epistemically*, roughly as Chalmers (2004, 2006*a*,*b*) understands them.

Because this is so, I'll call the thought 'h' *boring*.

If 'p' is a boring thought, then there will be no difference between the two-dimensional array for 'p' and "p' is true'. However, if 'p' is interesting, then 'p' and "p' is true' can have different truth-conditions. Take the thought "u' is true'. Consider first the possibilities in which the coin lands heads. In those possibilities, 'u' will say that the coin lands heads. Since the coin *does* land heads in those possibilities, what 'u' says in those possibilities will be true in those possibilities. So "u' is true' will be true. On the other hand, consider the possibilities in which the coin lands tails. In those possibilities, 'u' will say that the coin lands tails. Since the coin *does* land tails in those possibilities, what 'u' says in those possibilities will be true in those possibilities. So "u' is true' will be true in every possibility—and since nothing about the foregoing reasoning hinged upon which world is actual, "u' is true' will have these truth conditions no matter which world is actual.

"u' is true'	**heads**	**tails**
heads	T	T
tails	T	T

In general, when we ask whether 'p' is true at a possibility, we ask whether what 'p' *actually* says is true at that possibility. Thus, when we ask whether "p' is true' is true at a possibility, we ask whether what "p' is true' actually says is true at that possibility. But "p' is true' is a boring thought—it has the same truth-conditional content, no matter what the actual world is like. At every possibility, "p' is true' is true iff what 'p' says *at that possibility* is true at that possibility. And this doesn't depend upon which possibility is actual. So, as a helpful mnemonic: when you ask whether 'p' is true at a possibility, ask yourself whether what 'p' *actually* says is true at that possibility. But, when you ask whether "p' is true' is true at a possibility, ask yourself whether what 'p' says *at that possibility* is true at that possibility. In terms of the 'two-dimensional' array for 'p', this is tantamount to asking yourself whether 'p' is true at the *diagonal* cell in your column. That is: it is tantamount to asking yourself whether 'p' is true at a possibility, if that possibility is actual. So, in general, the truth-conditional content of "p' is true' is just the *diagonalised* content of 'p'. That is, to get the two-dimensional array for "p' is true', just take the two-dimensional array for 'p', and replace the truth-value of every non-diagonal cell in row r and column c with the truth-value which appears in the *diagonal* cell in row c and column c.

Because "u' is true' is necessarily true, it will have a chance of 100%, for every potential time t chance function, Ch. (At least, it is necessarily true so long as the coin lands at all, and its chance will be 100%, conditional on the coin landing.) And so our proposed principle of chance deference will tell you, correctly, to be 100% confident that the coin lands on Uppy, given that it lands at all.

This solution to the problem with *a priori* knowable contingencies falls naturally out, once we've modified our principle of chance deference to deal with *de se* thoughts. But we could have independently motivated the solution by noticing that *your* thoughts are not the same as *chance's* thoughts. (Recall: I use 'thought' stipulatively for whatever the arguments of your credence function are; and when I talk about *chance's* thoughts, I am talking about the arguments of the objective chance function.) Chance's thoughts are just truth-conditions, or sets of metaphysically possible worlds. Objective chances are something like brute propensities of the universe to develop in different ways. When we say that the objective chance of 'p' is n%, we mean that the universe has an n% propensity to develop in such a way that 'p' will accurately describe it. So it is only the truth-conditions of a thought which are relevant to the chances. If 'p' has the same truth-conditions as 'q', then the chance of 'p' must equal the chance of 'q'.[24] In terms of the two-dimensional arrays from above: chance's probabilities are invested in the cells lying along the actual row. In contrast, *your* thoughts are invested in the *diagonal* cells. For illustration, suppose that the coin actually lands heads. Then, 'u' and 'h' have precisely the same truth-conditions. So they have precisely the same chances. Nevertheless, your rational credence in 'h' is 50%, whereas your rational credence in 'u' is 100%. This can be explained within the two-dimensional array by noting that the *diagonalised* content of 'u' is necessary, whereas the *diagonalised* content of 'h' is contingent. That is: no matter what the actual world is like, 'u' will actually express a truth; whereas, if the coin actually lands tails, 'h' will actually express a falsehood.

So your thoughts and chance's thoughts are importantly different. However, so long as your thoughts are boring, this doesn't lead to any difficulties. If we are only considering boring thoughts, then the *diagonal* content in which you invest credence will be true at a possibility just in case the *truth-*

24. At least, I will be taking this for granted here. There are some who have responded to the kinds of puzzles from §2.1 by suggesting that chance distinguishes between truth-conditionally equivalent contents. See, for instance, Nolan (2016) and Salmón (2019). (Though, it's not clear to me whether my disagreement with Nolan and Salmón is substantive. They may be using 'chance' to refer to something other than *tychistic* chance, which is my exclusive focus here. See fns 1 and 13.)

conditional content to which chance attaches probability is true at that possibility, too. So diagonal and truth-conditional content will align. However, if your thought is interesting, like 'u', then diagonal content can come apart from truth-conditional content. For instance, suppose that the coin actually lands heads. Then, even though the diagonal content of 'u' is necessarily true, the truth-conditional content of 'u' is false at possibilities where the coin lands tails.

This explains both why Lewis's principle of chance deference LCD works so well when we confine our attention to boring thoughts, and why it runs into troubles with interesting thoughts like 'u'. It also points the way towards a resolution: we need to find appropriate boring surrogates for your interesting thoughts. We can then demand that your credence in the interesting thought match the objective chance of its boring surrogate. The natural candidate for a boring surrogate is the *diagonalised* content of 'p'—that is, the natural candidate is "'p' is true".

For interesting *de dicto* thoughts like 'u', diagonalised surrogates like these work perfectly well. For *de se* thoughts, the additional bells and whistles of locational surrogates are needed. And a principle of chance deference which utilises locational surrogates subsumes a principle utilising diagonalised surrogates. If an interesting thought 'p' is *de dicto*, then the locational surrogate 'p_λ' (given some location 'λ') will be *a priori* equivalent to "'p' is true". So, while we could have solved the problem with *a priori* knowable contingencies without wading into the complications of the *de se*, the *de se* principle of chance deference I've proposed here automatically solves the problems with *a priori* knowable contingencies.

3.3 Admissibility

As I formulated it above, the revised *de se* principle of chance deference only applies when you lack inadmissible information. However, if we combine this principle with *ur-prior conditionalisation*, it tells us exactly what your credences should be, even if you have inadmissible information. The principle of ur-prior conditionalisation I have in mind says that there should be some ur-prior credence function C_0 (a credence function which it would be rational to hold in the absence of any evidence) such that, for any 'e', when your total evidence is 'e', your credence in 'p', conditional on 'q', should be $C_0(p \mid q \wedge e)$.[25] Now, if we

25. See Meacham (2016) for more on ur-prior conditionalisation.

set 'q' in this principle equal to '$Ch_t = Ch \wedge \lambda$', it tells us that

$$\begin{aligned} C(p \mid Ch_t = Ch \wedge \lambda) &\stackrel{!}{=} C_0(p \mid Ch_t = Ch \wedge \lambda \wedge e) \\ &= \frac{C_0(p \wedge e \mid Ch_t = Ch \wedge \lambda)}{C_0(e \mid Ch_t = Ch \wedge \lambda)} \end{aligned}$$

Now, we may apply our principle of chance deference to both the numerator and the denominator of the fraction above. After all, the ur-prior credence function C_0 doesn't have any inadmissible evidence—it doesn't have any evidence at all! So:

$$C(p \mid Ch_t = Ch \wedge \lambda) \stackrel{!}{=} \frac{Ch((p \wedge e)_\lambda)}{Ch(e_\lambda)} = \frac{Ch(p_\lambda \wedge e_\lambda)}{Ch(e_\lambda)} = Ch(p_\lambda \mid e_\lambda)$$

If you lack any time t inadmissible information, then our principle tells us that $C(p \mid Ch_t = Ch \wedge \lambda)$ should *also* be $Ch(p_\lambda)$. Therefore, if the evidence 'e' is time t admissible, it should be that $Ch(p_\lambda \mid e_\lambda) = Ch(p_\lambda)$, for any thought '$p$', and any potential chance function and location, Ch and 'λ'. Set 'p' equal to 'e', and this implies that it should be that $Ch(e_\lambda) = Ch(e_\lambda \mid e_\lambda) = 100\%$, for any potential Ch and 'λ'. So the principle of ur-prior conditionalisation has provided us with a sufficient condition for inadmissible information. If $Ch(e_\lambda) < 100\%$ for any potential time t chance function and location, Ch and 'λ', then 'e' is time t inadmissible.

I propose we strengthen this sufficient condition for inadmissibility into a necessary and sufficient condition. That is, I propose the following criterion of inadmissibility:

> INADMISSIBLE INFORMATION
> 'e' is time t *inadmissible* iff, for some potential location and time t chance function, 'λ' and Ch,[26]
>
> $$Ch(e_\lambda) < 100\%$$

In this definition, a location 'λ' and a time t chance function Ch are *potential* iff your evidence is consistent with λ being your location and Ch being the time t objective chance function. That is: λ and Ch are a *potential* pair of location and

26. Any name or definite description which you know for sure to denote a unique time is an acceptable substituend for 't'. So, for instance, in the right circumstances, either '5:55 Tuesday morning', or 'five minutes from now' could be substituted for 't'. The same goes for the 't' which appears in the principle DSCD below.

time t chance function iff your total evidence doesn't entail '$\sim(\mathcal{C}h_t = Ch \wedge \lambda)$'. In a slogan, the criterion tells us that 'e' is inadmissible iff it might be news to the objective chances.

Given this criterion for inadmissibility, we may provide a fully general principle of chance deference which applies even in cases where you have inadmissible information.

> *DE SE* CHANCE DEFERENCE
>
> If 'e' is your time t inadmissible information, then your credence in 'p', given that the time t objective chance function is Ch, and given that you are located at λ, should be equal to $Ch(p_\lambda \mid e_\lambda)$.[27]
>
> (DSCD) $$C(p \mid \mathcal{C}h_t = Ch \wedge \lambda) \stackrel{!}{=} Ch(p_\lambda \mid e_\lambda)$$

If you do not have any time t inadmissible information, then 'e' will be a tautology, and the principle will tell us that $C(p \mid \mathcal{C}h_t = Ch \wedge \lambda)$ ought to be $Ch(p_\lambda)$.

We've already seen how this principle solves our first problem (the problem with *a priori* knowable contingencies). It also solves the second problem (the problem with losing track of the time). Recall, in the problem case, you are 50% sure that today is Monday, 50% sure that today is Tuesday, and you know for sure that today, the chance of Secretariat winning the race ('w') is 75%, and that yesterday, the chance of 'w' was 25%. Let 'μ' be any Monday location, and let 'τ' be any Tuesday location. Then, notice that the information that today's chance of 'w' is 75%—'$\mathcal{C}h_{today}(w) = 75\%$'—is Monday inadmissible. The reason is that this information might be news to the Monday chance function. For τ is a potential location, and if you are at the location τ, then the τ-surrogate of '$\mathcal{C}h_{today}(w) = 75\%$' (namely: the *Tuesday* chance of 'w' is 75%) is news to the Monday chance function.

In this case, there are two relevant kinds of potential Monday chance functions: those according to which the chance of 'w' is 75% and those according to which the chance of 'w' is 25%. Take an arbitrary function of the first kind and call it '$Ch^{75\%}$'. Take an arbitrary function of the second kind and call it '$Ch^{25\%}$'. You know for sure that $\mathcal{C}h_{mon} = Ch^{75\%}$ only if today is Monday, and you know for sure that $\mathcal{C}h_{mon} = Ch^{25\%}$ only if today is Tuesday. Now, since

27. If '$\mathcal{C}h_t = Ch \wedge \lambda$' has a credence of zero, then this conditional probability should be relativised to the partition of every epistemically possible conjunction which has the form '$\mathcal{C}h_t = Ch \wedge \lambda$', with '$\mathcal{C}h_t$' fixed and '$Ch$' and '$\lambda$' variable.

'$Ch_{today}(w) = 75\%$' is your total inadmissible information, DSCD implies that

$$\begin{aligned} C(w \mid Ch_{mon} = Ch^{75\%} \wedge \mu) &\overset{!}{=} Ch^{75\%}(w \mid Ch_{today}(w) = 75\%_\mu) \\ &= Ch^{75\%}(w \mid Ch_{mon}(w) = 75\%) \\ \text{and} \quad C(w \mid Ch_{mon} = Ch^{25\%} \wedge \tau) &\overset{!}{=} Ch^{25\%}(w \mid Ch_{today}(w) = 75\%_\tau) \\ &= Ch^{25\%}(w \mid Ch_{tues}(w) = 75\%) \end{aligned}$$

Assuming that the chance function knows its own values for sure, $Ch^{75\%}(Ch_{mon}(w) = 75\%) = 100\%$, so the first constraint above implies that

$$C(w \mid Ch_{mon} = Ch^{75\%} \wedge \mu) \overset{!}{=} Ch^{75\%}(w) = 75\%$$

And, assuming that the objective chances defer to their future selves,[28] $Ch^{25\%}(w \mid Ch_{tues}(w) = 75\%) = 75\%$, so the second constraint above implies that

$$C(w \mid Ch_{mon} = Ch^{25\%} \wedge \tau) \overset{!}{=} 75\%$$

Since $\mu, \tau, Ch^{75\%}$, and $Ch^{25\%}$ were arbitrary, the same will hold for *any* potential Monday location, *any* potential Tuesday location, *any* potential Monday chance function which gives a 75% probability to 'w', and *any* potential Monday chance function which gives a 25% probability to 'w'. Since these are the only kinds of potential locations and Monday chance functions, we will have in general:[29]

$$C(w) \overset{!}{=} 75\%$$

And the second problem is resolved.

4 | SLEEPING BEAUTY

The principle of chance deference I've developed here has a surprising consequence for Adam Elga's *Sleeping Beauty* puzzle.[30] In this puzzle, we imagine that on Sunday evening, you are informed of the following: you will be put to sleep with a powerful sedative and awoken on Monday morning. On Monday evening, you will be put back to sleep and a fair coin will be flipped. If this coin

28. More carefully, I am assuming that, for any times t, t^* such that $t < t^*$, and any p in the domain of the chance function, $Ch_t(p \mid Ch_{t^*}(p) = x) = x$.

29. Here, I again appeal to the principle of *conglomerability*. See footnote 22.

30. This puzzle is first presented in Elga (2000).

	Monday	*Tuesday*
Heads	1/3	
Tails	1/3	1/3

(a)

	Monday	*Tuesday*
Heads	1/2	
Tails	1/4	1/4

(b)

FIGURE 1: The *thirder* thinks you should have the credence distribution in figure 1a, whereas the *halfer* thinks you should have the credence distribution in figure 1b.

lands heads, then you will be kept asleep throughout Tuesday, and you will not be awoken again until Wednesday. If, on the other hand, the coin lands tails, then your memories of Monday will be erased, and you will be awoken again on Tuesday. Also, just by the way: you are beautiful.

When you awake on Monday morning, you know for sure that, if it is Tuesday, then the coin flip on Monday landed tails. However, you don't know for sure whether it is Monday or Tuesday. For all you know for sure, it is Tuesday and your memories of being awoken on Monday have been erased. The central debate over *Sleeping Beauty* concerns how confident you should be that Monday's flip landed heads, 'h'. So-called *thirders* say that your credence in 'h' should be one third. They advocate the credence distribution shown in figure 1a.[31] So-called *halfers* are unhappy with this distribution, in part because it means that your credence in 'h' departs from the known Monday *chance* of 'h'. They say instead that your credence in 'h' should be one half.[32] They advocate the credence distribution shown in figure 1b.[33]

Let's use 'μ' for any arbitrary Monday location, and 'τ' for any arbitrary Tuesday location. Let 'Ch' be any potential Monday chance function. And let 'a' be the thought 'I am awake'. Importantly, 'a' is information you have when you wake up on Monday—this is the information which allows you to rule out that it is Tuesday and the coin landed heads.[34] Moreover, given our criterion for inadmissibility, this information will count as Monday inadmissible. For τ

31. See, for instance, Elga (2000), Elga (2004), Dorr (2002), Arntzenius (2003), Hitchcock (2004), Horgan (2004), and Weintraub (2004).

32. See, for instance, Lewis (2001), Halpern (2004), Bostrom (2007), and Meacham (2008).

33. Of course, the *thirder* and *halfer* positions are not exhaustive. For one alternative, see the 'imprecise' suggestion discussed in Monton (2002) and defended in Singer (2014).

34. Horgan (2004) and Weintraub (2004) both make the observation that you learn 'a' upon awaking.

is a potential location, and the τ-surrogate of 'a', 'a_τ'—which says that you are awake on Tuesday—is news to the Monday chances. Because you're awake on Tuesday iff the coin lands tails, the Monday chances think that there's only a 50% probability that you'll be awake on Tuesday, $Ch(a_\tau) = 50\%$. (Of course, 'a_μ' is *not* news to the Monday chances—the Monday chances know for sure that you are awake on Monday.)

Then, DSCD implies that

$$C(h \mid Ch_{mon} = Ch \wedge \mu) \overset{!}{=} Ch(h_\mu \mid a_\mu)$$

But the Monday chances are already certain that a_μ, and 'h' is a boring and *de dicto* thought, so its μ-surrogate 'h_μ' is just 'h', so this reduces to

$$C(h \mid Ch_{mon} = Ch \wedge \mu) \overset{!}{=} Ch(h) = 50\%$$

Moreover, since this holds for *any* potential Monday chance function Ch, this implies that[35]

$$C(h \mid \mu) \overset{!}{=} 50\%$$

And since this holds for *any* potential Monday location μ, this in turn implies that

$$C(h \mid Monday) \overset{!}{=} 50\%$$

(where '*Monday*' is the *de se* thought that today is Monday.)

This is a powerful constraint. It is incompatible with the halfer's favoured distribution, and compatible with the thirder's. So, surprisingly, if we accept the principle of chance deference which I've developed here (for quite independent reasons), then it will be the *thirder*, and not the halfer, who properly defers to the known chances. It is of course true that the thirder's credence in 'h' is not *equal* to the known chance of 'h'. But, if we accept my proposed criterion of inadmissibility, then the thirder has a ready excuse: their credence in 'h' departs from the known chance of heads because they have the inadmissible information that they are awake. This is not information which is *about* times after Monday, so it will not count as inadmissible according to Lewis's criterion. It is, after all, Monday, and there are, after all, no time travellers, oracles, crystal balls, nor any other form of divination or prognostication. Nonetheless, it is information which might be news to the Monday chances—for it might be Tues-

35. This and the next inference rely upon the principle of conglomerability. See fn 22.

day, and if it is Tuesday, then your being awake is news to the Monday chances. So it counts as inadmissible information given our criterion. And, given that they have this inadmissible information, the thirder is correctly showing deference to the objective chances.

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